COMPLIANCE TRAINING ONLINE

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Since 2008

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Gases

Underground Stone

and

Limestone Mines

Objectives

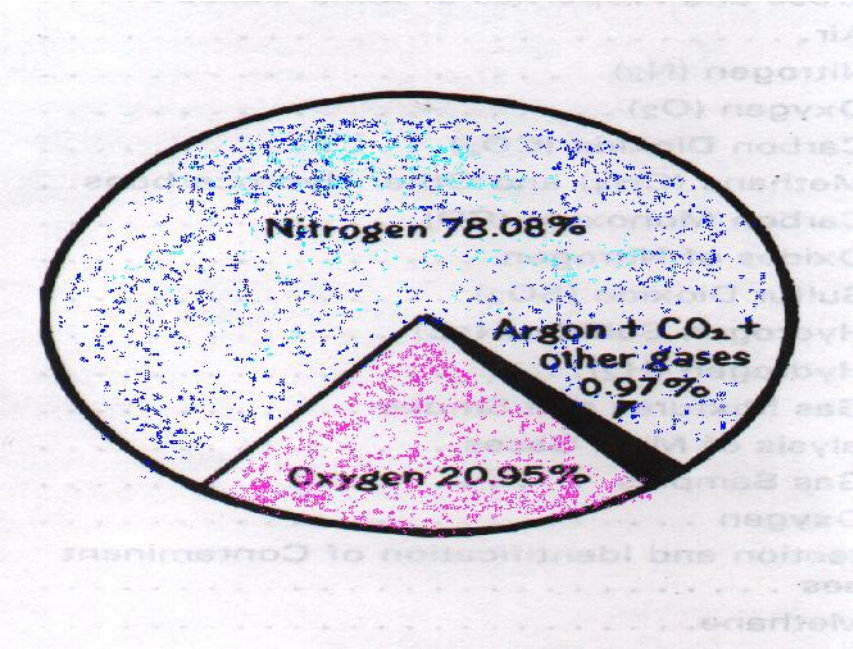
- Identify mine gases
- Describe the hazards of mine gases
- Explain the effects of gas exposures
- Describe control measures
- Explain safe work procedures to reduce risks from gases

Consequences of Gas Incidents

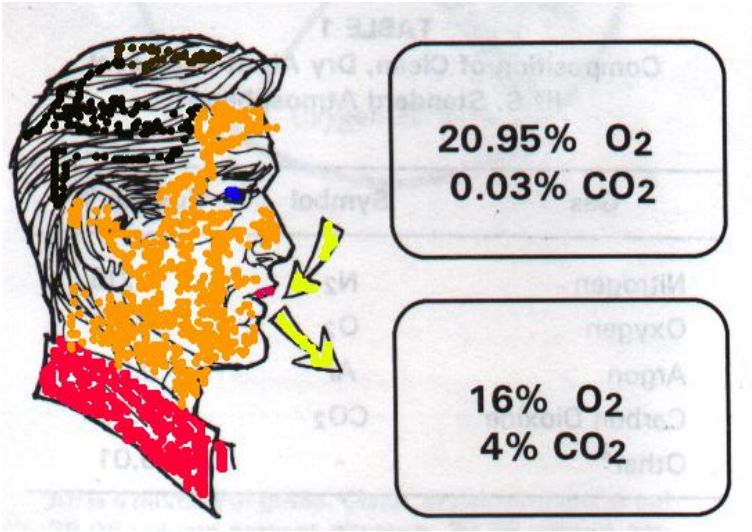
- On April 10, 2000 four miners entered an area in the mine of very low oxygen and collapsed
- Quick action by others saved four lives
- A section foreman and a mine foreman entered an area of low oxygen . Both men collapsed
- The section foreman was asphyxiated while the mine foreman regained consciousness and summon help

Sources and Properties of Mines Gases

- Air
- The air we breath is a mixture of gases and is necessary for life.
- Air is used in mining to remove unwanted gases and dust.



Air



- At rest we breath about 16 times on average per/min and consume about 480 cu. inches of air.
- Moderate exercise we breath about 30 per min. and consume 3,000 cu. inches of air.

Air

- As air passes through a mine, it picks up other gases as well as dust formed by mining
- At the same time, air loses oxygen to the mine surroundings and to the people in the mine

Oxygen(O2)

- Specific gravity: 1.105
- Oxygen will not burn or explode
- Source: Atmosphere
- Characteristics; No color, odor or taste

Percentage of Oxygen and Breathing

- 21%
- 19.5%
- 17%
- 15%
- 9%
- 6%

- Breathing easiest
- Minimum required by law
- Breathing faster &deeper
- Dizziness, buzzing noise, rapid pulse, headache, blurred vision
- Unconsciousness
- Breathing stops, cardiac arrest

Legal requirements (MSHA) for Oxygen

- In mining (underground, shop, confined space entry, etc.) the air we breath must contain at least 19.5% oxygen (O2) and not more than 0.5% of carbon dioxide
- Additionally, noxious (asphyxiant) or toxic(poisonous) gases must remain within prescribed threshold limit values (TLV)

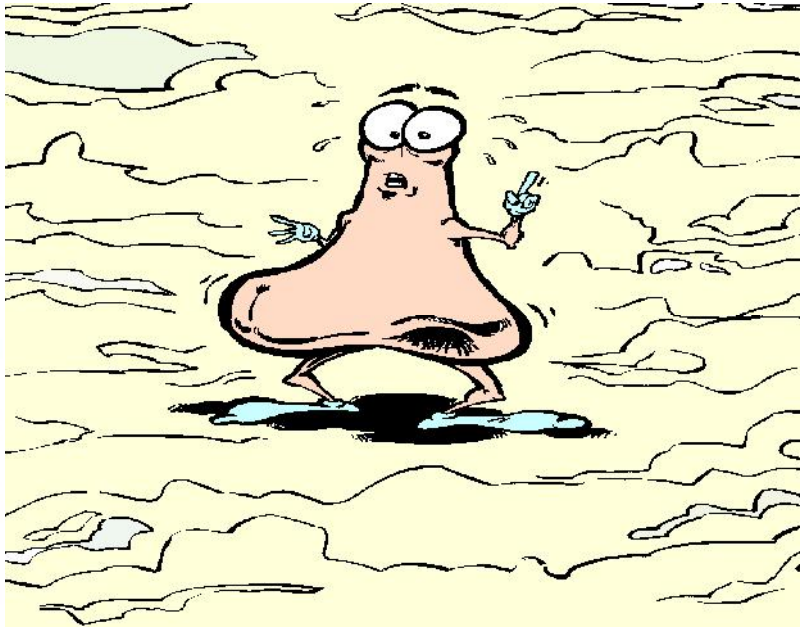
Nitrogen Dioxide (O2)

- Specific gravity: 0.967
- Source: Atmosphere
- Characteristics: No color, odor or taste

Oxides of Nitrogen

- Formed at high temperatures by diesel and gasoline engines, electrical discharges and blasting operations
- Toxic because they form very corrosive acids when mixes with moisture in the lungs
- Odor of blasting powder fumes

Carbon Dioxide (CO2)



- Specific gravity:1.529
- Source: Complete combustion, slow oxidation of carbon products Atmosphere
- Characteristics: No color or odor, acidic taste above 10%

Carbon Monoxide (CO)

- Specific gravity: 0.967
- Needs 6% O2 to ignite
- Source: Incomplete combustion, diesels, gasoline engines
- Characteristics: No color, odor, or taste
- 300 times more attracted to the hemoglobin than oxygen

Hydrogen (H2)

- Specific gravity: 0.0695
- Needs 5% oxygen to ignite
- Source: Water on super hot fire and battery charging

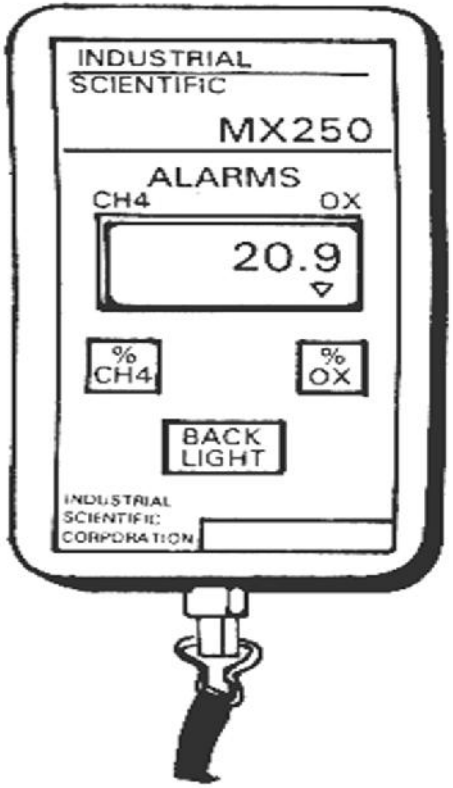
Gas Mixtures and Smoke

- Fire damp-methane
- Blackdamp-carbon dioxide and nitrogen in an oxygen-deficient atmosphre
- Afterdamp-gaseous products and smoke produced by a fire or explosion
- Rock gas-nitrogen and carbon dioxide
- Smoke-soot and tars suspended in the air

Gas Detection

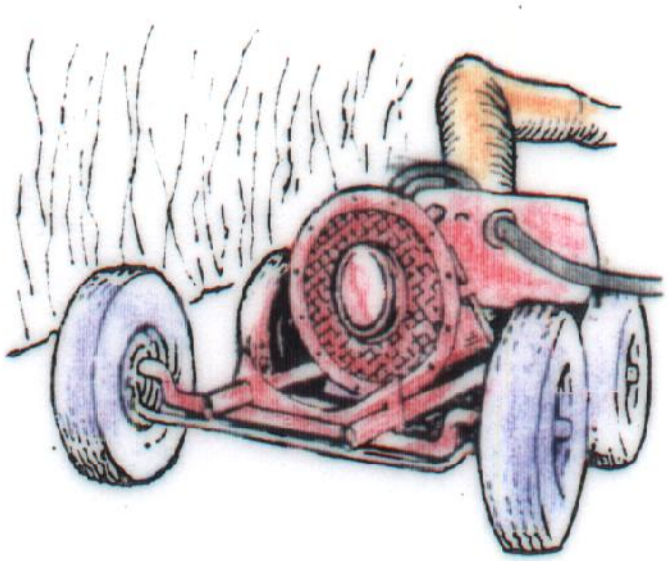
- One of the most reliable ways to evaluate the mine atmosphere is to use detectors approved by MSHA

Gas Detection Instrument



- Detector must be calibrated
- Detector must be maintained in working order
- Operator of the detector must know the capabilities and limitations of detector

Control of Mine Gases



- Under <u>NORMAL CONDITIONS</u> increased quantities of air is the primary defense against unwanted gases

Control of Mine Gases

- <u>ABNORMAL CONDITIONS</u> can be created by;
- Ventilation problems
- Outbursts of gases
- Fires
- Explosions

Emergency Preparation Caused by Abnormal Gas conditions

- Know escape routes
- Know when and how to use self-rescuer
- Use of other respiratory protection
- Location of shelters
- How to build a barricade

Gas Quiz

- What is the normal percentage of oxygen in a mine atmosphere?

- 21%

Gas Quiz

- What is the minimum percentage of oxygen required in a mine for miners to work and travel?

- 19.5%

Gas Quiz

- At what percentage of oxygen will a person become unconsciousness in an oxygen deficient atmosphere?

- 9%

Gas Quiz

- What gases are the result of blasting and what effect do these gases have on a person's lungs?

- Oxides of nitrogen
- Pulmonary edema

Gas Quiz

- What gas has proven deadly to not only miners but thousand of people in their homes?

- Carbon monoxide

Gas Quiz

- Carbon monoxide is present in a mine fire and the best protection that a miner has from this gas is to use what device?

- Self-rescuer

Gas Quiz

- Why is carbon monoxide so dangerous to a miner?
- Combines more readily than oxygen with the blood's hemoglobin and limits the oxygen carrying capacity of the blood

Gas Quiz

- What is a reliable way for detecting quantities of mine gases?

- Detector

Gas Quiz

- What is the best way to control mine gases?
- Increased ventilation

Gas Quiz

- What are several defense mechanisms that a miner can rely on if a fire or other abnormal gas conditions exist?
- Self-rescuer
- Escapesway to surface